

REMARKS

By this amendment claim 1 has been amended to more particularly point out and distinctly claim the subject matter which applicants regard as the invention. No claims have been canceled and no new claims have been added to the application. Accordingly, claims 1 and 3-5 are pending in the application. No new matter has been added.

In the prior Office Action, the Examiner rejected claim 1 under 35 U.S.C. §103(a) as being unpatentable over Nakazawa et al. (US 6,274,805) in view of Basol et al. (JP 11-340482), Takeshi (JP 08-126206) and Taiyo (JP 61-15763). Applicant respectfully requests reconsideration of the rejection of claim 1.

Nakazawa et al. is directed to a chalcopyrite type solar cell comprising a stack retained on a flexible insulative substrate. The stack includes a first electrode composed of a metal, a light adsorption layer formed on or above the first electrode and a second electrode formed on or above the light adsorption layer. The light adsorption layer is composed of a chalcopyrite type compound, which serves as a P-type semiconductor. The second electrode serves as an N-type semiconductor. Nakazawa et al. clearly does not disclose the following elements of claim 1:

- that mica is contained in an insulative substrate that retains said stack;
- that a smoothing layer having irregularities on an upper end surface thereof is provided between said insulative substrate and said stack, said irregularities of the smoothing layer being smaller than irregularities on an upper end surface of said insulative layer; and
- that a binder layer and a diffusion-preventive layer are interposed between said insulative substrate and said stack such that said binder layer and said diffusion-preventive layer sandwich said smoothing layer, said diffusion-preventive layer being provided between said smoothing layer and said insulative substrate and

preventing diffusion of impurities from said insulative substrate, each of said binder layer and said diffusion-preventive layer containing TiN or TaN, and each of said binder layer and said diffusion-preventive layer having a thickness of 0.5 to 1 μm .

The Examiner cites Basol et al. (paragraph [0017]) as support for the proposition that it is known that mica can be used in substrates of chalcopyrite type solar cells. The Examiner cites Taiyo (p. 4, lines 25-31 and p. 5, line 11-15) for the proposition that it is known that glass pastes can be used to make a smoothing layer having irregularities on an upper end surface that are smaller than irregularities on an upper end surface of an insulative layer containing mica on which the smoothing layer is formed. For purposes of this Amendment, applicant does not take issue with either these two propositions.

The Examiner also cites Takeshi (Abstract) for the proposition that it is known that a TiN binder layer can be formed "between two layers" to prevent the peeling of an alloy film regardless of heat treatment. Applicant respectfully submits that the Examiner's proposition is much broader than what is actually and fairly taught by Takeshi (Abstract). Takeshi (Abstract) teaches that TiN (or TiC) can advantageously be disposed between layers of soft glass and molybdenum during fabrication of a solar cell to prevent peeling of a subsequently applied conductive film and a CuInSe_2 alloy film regardless of heat treatment because TiN has a thermal coefficient of expansion that is close to that of soft glass and fully fits to both glass and molybdenum. Takeshi (Abstract) teaches absolutely nothing whatsoever regarding the use of a TiN film between layers other than soft glass and molybdenum, and in particular, does not teach that TiN should be provided between a mica-containing substrate and a smoothing layer containing one of SiN and SiO_2 .

Furthermore, claim 1 of the present application specifies that each of said binder layer and said diffusion-preventive layer has a thickness of 0.5 to 1 μm . Takeshi (Abstract) does not specify the thickness of the single binder layer disposed between the soft glass and the molybdenum. Applicant notes that Nakazawa et al., which the Examiner cites as the primary reference in the claim rejection, teaches that binder layers in chalcopyrite structures need only to be 0.01 μm to 0.1 μm (see col. 6, lines 28-30). Thus, if one having ordinary skill in the art were motivated to include a binder layer of TiN as proposed by the Examiner, the person of ordinary skill in the art would apply a binder layer having a thickness within the range of 0.01 μm to 0.1 μm , and not having a thickness of 0.5 to 1 μm as claimed in claim 1.

The Examiner argues that applicant has provided no criticality regarding the thickness of the films, and then states that "where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device." (see MPEP 2144.04(IV)). Applicant respectfully submits that the Examiner is mistaken on both accounts (i.e., criticality has been established and a device having the claimed relative dimensions would perform differently than a device according to the prior art).

Applicant's specification clearly explains the criticality of the range of thickness claimed. On page 14 of the specification, at lines 1-4, with respect to the binder layers, applicant teaches that:

If the thickness is less than 0.5 μm , the binder layer 56 cannot function easily as a barrier. On the other hand, if the thickness exceeds 1 μm , the joining strength of the binder layer 56 cannot be ensured.

The above-quoted teaching establishes the criticality of the claimed range. If the binder layer is less than 0.5 μm thick, then impurities from the mica contained in the substrate can diffuse toward the light absorption layer and thereby decrease the functionality of the chalcopyrite type solar cell. If the binder layer is thicker than 1 μm , then the joining strength of the binder layer cannot be ensured.

Furthermore, the above-quoted teaching establishes that a chalcopyrite solar cell formed according to the claimed invention will perform differently than a chalcopyrite solar cell formed in accordance with the prior art. A chalcopyrite type solar cell formed according to the invention as claimed will have a sufficiently thick enough barrier layer to prevent impurities from the mica-containing substrate from diffusing toward the light absorption layer, which would decrease the functionality of the cell. On the other hand, a chalcopyrite type solar cell formed by conventional methods (i.e., including a binder layer having a thickness of 0.01 μm to 0.1 μm), would not prevent diffusion of such impurities and would thus not perform as well. Claim 1 is clearly patentable over the prior art of record.

Also in the prior Office Action, the Examiner rejected claim 3 under 35 U.S.C. §103(a) as being unpatentable over Nakazawa et al. in view of Basol et al., Takeshi and Taiyo as applied to claim 1 further in view of Sakai et al., U.S. Pat. No. 6,750,283. The Examiner contends that Sakai et al. teaches that it is known in the composite art that a composite comprising aggregate mica and a resin makes an excellent substrate due to its high hardness and its ability to be bent or thinned. Applicant respectfully submits that Sakai et al. teaches a non-analogous stone-like construction material that is not sintered, as required by claim 3, and thus that no person having ordinary skill in the art would have been motivated by the teachings of Sakai et al. to form an insulative

substrate of a chalcopyrite type solar cell that using a mica aggregate, which is sintered after mixing said mica and a resin, as claimed.

Claim 4 depends from claim 3 and claim 5 depend from claim 1. Applicant respectfully submits that claims 4 and 5 are patentable over the prior art of record the same reasons that claims 3 and 1 are patentable over the prior art of record, respectively.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested. If it is determined that the application is not in a condition for allowance, the Examiner is invited to initiate a telephone interview with the undersigned attorney to expedite prosecution of the present application.

If there are any additional fees resulting from this communication, please charge same to our Deposit Account No. 18-0160, our Order No. TOH-16912.

Respectfully submitted,

RANKIN, HILL & CLARK LLP

By: /Randolph E. Digges, III/
Randolph E. Digges, III, Reg. No. 40590

38210 Glenn Avenue
Willoughby, Ohio 44094-7808
(216) 566-9700